

Informational Leaflet 49

ABUNDANCE, SIZE AND AGE OF RED SALMON FROM THE UGASHIK LAKES SYSTEM, BRISTOL BAY, 1963

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INTRODUCTION

In 1963, the Alaska Department of Fish and Game conducted the red salmon (*Oncorhynchus nerka*) smolt program of enumeration and sampling at the outlet of the Ugashik Lakes system, Bristol Bay.

Smolt enumeration and sampling on the Ugashik Lakes was initiated in 1955 by the U.S. Bureau of Commercial Fisheries. In 1956 and 1957 the studies were carried out by the Fisheries Research Institute of the University of Washington. The Bureau continued the smolt studies from 1958 through 1962. The Department of Fish and Game assumed responsibility for the Ugashik smolt studies for the first time in 1963.

The abundance, size, age, and condition of red salmon smolts, determined over a period of years, provide one basis for predicting returning runs. Forecasts based on escapement-return relationships have generally proven inadequate, due to the wide fluctuation in survival rates in fresh and salt water. Measure of smolt abundance is expected to provide a better indication of the size of returning runs as the factors affecting the freshwater survival have already taken place.

This report is a summary of the data obtained in 1963. Results are comparable with past data, as methods developed and used by the Fisheries Research Institute and the U.S. Bureau of Commercial Fisheries were continued without major modification.

Mr. Herbert W. Jaenicke, of the Bureau of Commercial Fisheries, computed the random sampling catch data and was responsible for the age, weight, and length computations. Ages were determined from smolt scales by Charles DiCostanzo. Technical assistance was also provided by the Bureau during the early portion of the season.

OBJECTIVES

The primary objective of the Ugashik smolt program is to measure the relative abundance of red salmon smolts migrating seaward from the Ugashik Lakes. Other objectives are:

1. Determine the diurnal fluctuations and seasonal timing of the migration.
2. Determine the age and size composition of the smolts.
3. Determine the condition of the smolts.

4. Determine the relationship between the escapement levels and resultant smolt production.

DESCRIPTION OF AREA

The Ugashik Lakes system is comprised of two large lakes, of which Upper Ugashik Lake is the largest with a surface area of 86 sq. miles (Figure 1). Lower Ugashik Lake has a surface area of 74 square miles. Both lakes have surface elevations of 10 feet above sea level.

The smolt sampling site is located 150 yards below the outlet of Lower Ugashik Lake (Figure 2). The tidal influence in the 34 mile long Ugashik River extends to within one-quarter mile of the smolt sampling site.

At the sampling site the Ugashik River is 297 feet wide and has a flow of approximately 3,600 cubic feet per second (as determined on June 28, 1962).

Red salmon escapements have been enumerated in the Ugashik Lakes system since 1926. Weirs were employed to enumerate the escapements from 1926 to 1932 and 1949 to 1956 while the counting tower method has been in use since 1957. The red salmon escapement has ranged from a low of 214,802 in 1957 to the high of 2,304,200 in 1960. The average escapement during the period 1956 through 1963 is 554,424.

METHODS

Fyke Net Design

Fyke nets constructed of 1/2" mesh nylon webbing in the wings and body and 1/4" mesh nylon webbing in the funnel were used to trap the smolts (Figure 3). The nets were hung from a steel frame, 4 feet wide and 4 or 5 feet deep. Each net had two 10-foot long lead-in wings. The wings were held open by the force of the river current while the two connecting spacer lines allowed the net to fish an 8-foot wide section of the river extending from the surface of the bottom.

The body of the net tapered from the frame to a single 4" x 10" rectangular funnel at the throat (Figure 3). Second funnel of the same dimensions was located in the detachable cod-end. A heavy duty zipper facilitated the emptying of the catch from the cod-end.

Trapping Techniques

The fyke nets were suspended from a 3/8-inch wire cable strung across the river bottom, and secured on both banks to buried "deadmen". Five standard fishing sites were located at intervals along the cable (Figure 2). A pair of manila headlines were tied to the cable at each fishing site. Numbered floats tied to the trailing ends of the headlines served to identify each site.

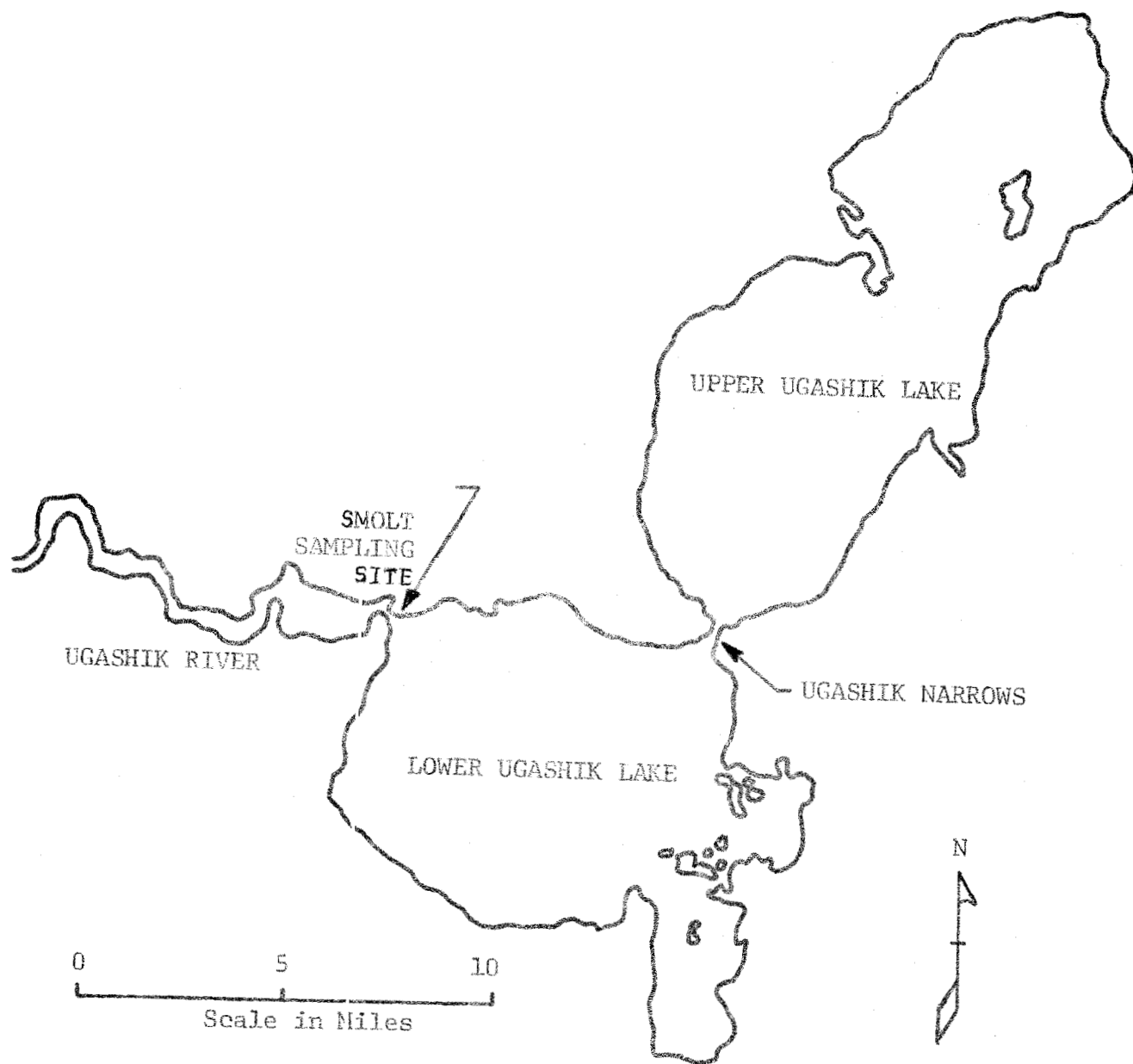


Figure 1. Ugashik Lakes system, Bristol Bay, Alaska

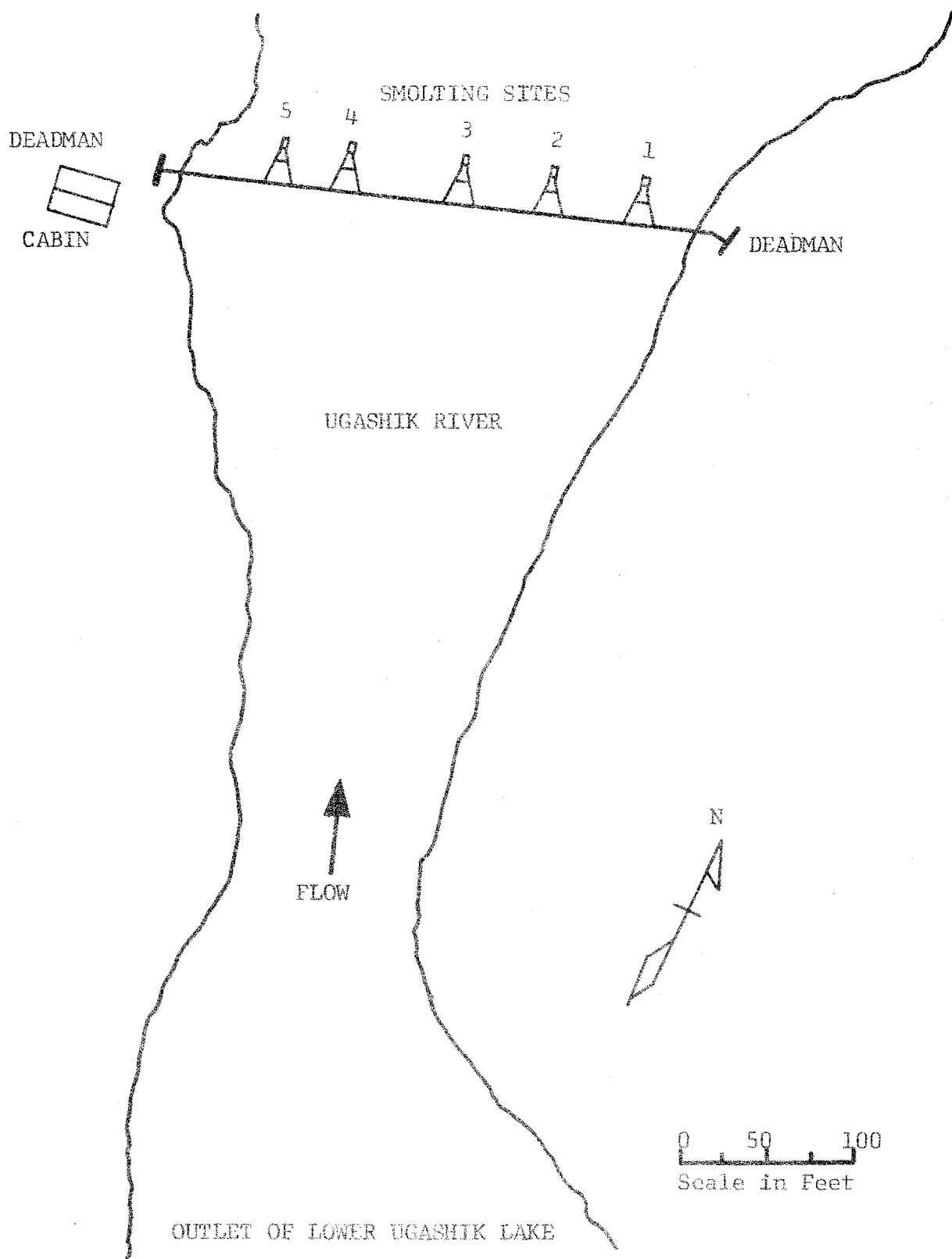


Figure 2. Ugashik River red salmon smolt sampling sites.

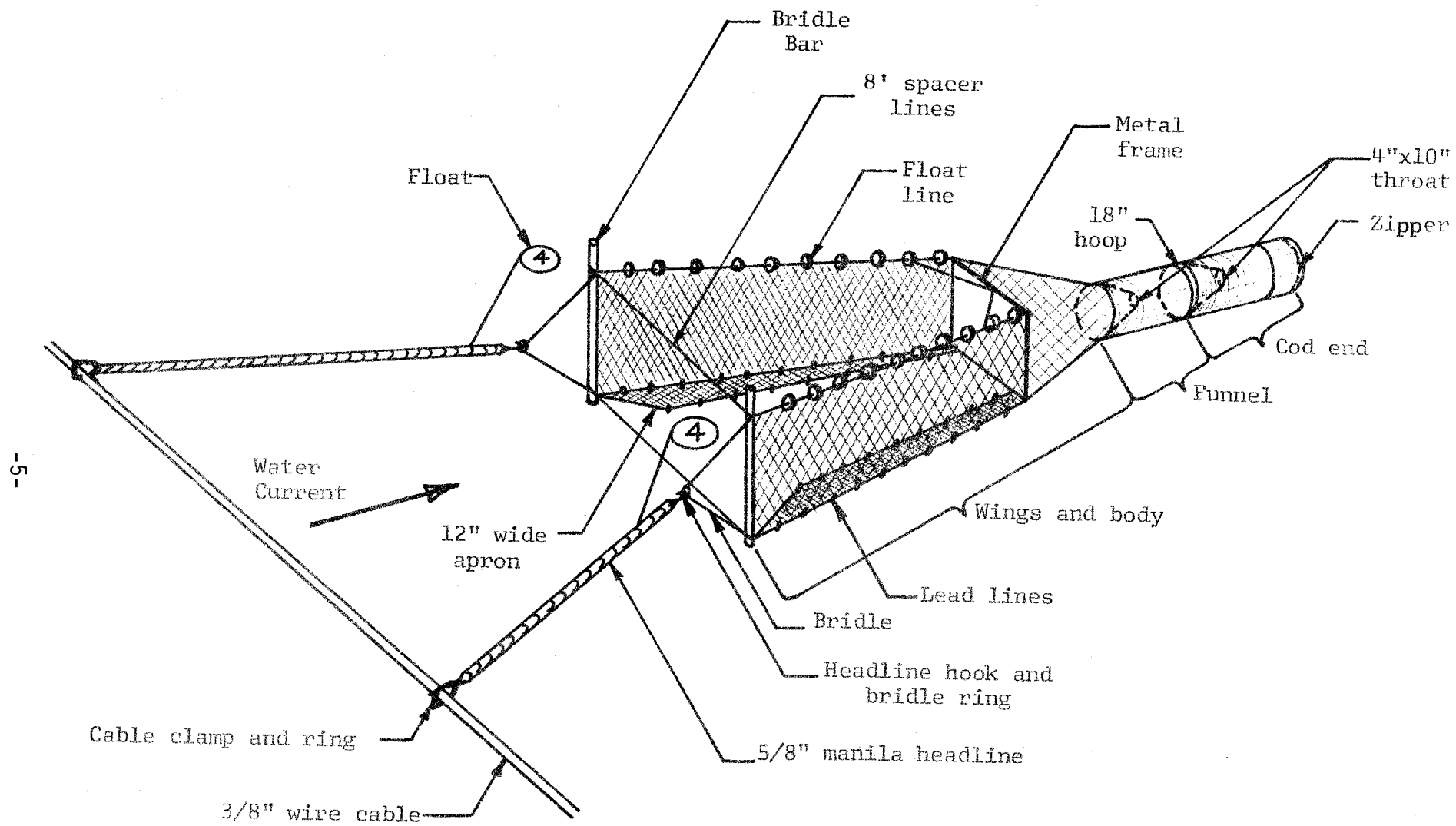


Figure 3. Nylon fyke net used to sample red salmon smolts, Ugashik River, 1963.

If the catch was small, the smolts were counted by hand and returned immediately to the river. If the catch was over 5 pounds, they were placed in a large weighing basket that was immersed in a tub of water. The weighing basket was then removed from the tub and hung on a spring balance of 60 pound capacity suspended from a weighing stand in the skiff. The total catch during each night's fishing was recorded in pounds from each cod-end check. When individual catches were weighed, 1 pound sample counts were made in order to convert total weight into numbers of fish. Fish were released at the fyke net site except when specimens were needed for length, weight, and age analysis.

The number of smolts in the cod-end was determined every 60 or 90 minutes, except during heavy migrations when the cod-end had to be emptied at more frequent intervals in order to reduce mortality.

Sampling Designs

In studies by the Fisheries Research Institute prior to 1958, it was determined that smolt migrated in greatest numbers between 8:00 p.m. and 2:00 a.m. Accordingly, all smolt catches between these hours yielded a daily smolt index which was totaled for the entire season.

In 1958, the Bureau assumed the responsibility for sampling the smolt migration from the Ugashik Lakes system. Fishing at index site No. 4 was continued to maintain continuity with previous methods of indexing. In addition to the index method, a random sampling scheme using more nets and sites was established to derive an estimate of the total outmigration of smolts.

The random sampling scheme, popularly called the "latin square" method, employs the use of five fishing sites located across the entire width of the river (Figure 2).

Each of the five sites was fished in a random order for a period of 1 hour between 9:00 p.m. and 2:00 a.m. during 4 days of each 5-day period. On any sampling day each site was fished only once during the five hourly periods. Specific combinations of site and time periods were sampled only once every 5 sampling days.

Estimates of the total number of smolts were derived by applying the average catch per set to the total number of possible sets as follows:

$$\hat{x} = \bar{x}ab$$

Where \hat{x} = estimate of total number of smolts

\bar{x} = average catch per standard fishing period (1 hour)

a = width of river at sampling station (280 feet)¹
divided by width of fyke net opening (8 feet)

b = total number of sampling periods (five per day)

¹ The river at the sampling site is 297 feet wide; however, a 17-foot shallow section extending outward from the left bank is situated out of the main current in an eddy. Past visual observations indicate that smolts do not migrate downstream in this section; consequently, the effective width of the migration path is assumed to be 280 feet.

The estimate of the total number of smolts were adjusted upward to include migration between 2:00 a.m. and 9:00 p.m. The index net was fished continuously for 24 hours every fifth day to determine the ratio of night to day-time catches. The random sampling nets were not fished during nights when the 24-hour fishing schedule was in effect.

To derive the estimate of the number of smolt migrating between 2:00 a.m. and 9:00 p.m. the following proportion was used.

$$T = \frac{y}{\hat{x}} = \frac{100.00}{T}$$

Where T = total outmigration of smolts (as determined by the above computation)

y = percent smolt migrating between 9:00 p.m. and 2:00 a.m.

\hat{x} = estimate total number of smolts migrating between 9:00 p.m. and 2:00 a.m.

Collection of Biological and Physical Data

A representative sample of smolts was saved from each cod-end catch of the index net each sampling night. The 6-hour index sampling period was broken down into three 2-hour periods and one or more samples were collected during each 2-hour period. The smolts were placed in plastic containers and later transferred and held in a live pen which was divided into three sections, one section for each 2-hour period.

At the end of each night's fishing schedule a 1-pound sub-sample of smolts was taken from each of the three 2-hour samples. The 1-pound samples of fish were anesthetized in MS-222 (*Tricaine methanesulfonate*), measured using the fork length method, weighed in grams, and returned to the water unharmed. Scales for age determination were taken throughout the season for the 1-pound sub-samples.

Air and water temperatures, water levels, wind direction, and velocity were determined daily at pre-determined periods with a pocket thermometer, water level gauge mounted in the river and a Dwyer wind meter, respectively.

RESULTS

Timing of the Outmigration

Past records indicate that the Ugashik River red salmon smolt outmigration normally commences shortly after breakup of lake ice on Lower Ugashik Lake and after the water temperature at the lake outlet reaches 37°- 39° F.

The mild winter of 1962-63 resulted in a small ice pack, and breakup occurred approximately in mid-April, two to four weeks earlier than is normal. The early breakup caused apprehension that the smolt run might already have commenced. Consequently, fishing began on May 5, and the small catches thereafter for a period of 10 days gave evidence that the outmigration was probably just

starting and that no significant migration occurred prior to this time (Tables 1 and 3).

The beginning of the heavy seasonal migration began when the lake outlet water temperature reached 38° - 39° F on May 16. It is evident that the water temperature at the lake outlet is the major factor controlling the timing of the outmigration from Lower Ugashik Lake.

The catches during the index hours followed the usual pattern. Red salmon smolts were captured in the largest numbers during the darkest hours of the night, as shown by the index and random net catches (Tables 1 and 2). The greatest intensity of migration in the index net occurred between the hours of 10:00 p.m. and 1:00 a.m. when 73.5 percent of the season's index net catch was trapped (Table 1). A sharp decline in index net catch per period took place after 2:00 a.m. (Table 2). During the 24-hour sampling periods 85.0 percent of the smolts were taken between the hours of 9:00 p.m. and 2:00 a.m.

As in the past, the daily index net catches indicated an erratic migration pattern (Figure 4). Peak index catches occurred at intervals throughout the season, with the largest index catch being made on May 27, when over 150,000 smolts were trapped (Figure 4 and Table 1).

Trapping was discontinued on June 26 because of the relatively few fish being trapped during the preceding days.

Index of Abundance

The total catch of red salmon smolts during the index hours for the entire season was 1,250,319 (Table 1 and Figure 5).

The 1963 Ugashik River smolt outmigration was the largest on record. The 1963 index exceeds the previous high, 1962, by over 172 percent (Figure 5).

The random sampling catch, which provides an estimate of the total outmigration was also the largest on record. The total outmigration estimate was 33,750,496 smolts, which was over 102 percent higher than the previous record outmigration of 1962 (Table 7). Both methods of smolt enumeration are compared on Figure 6.

As in the past, trapping sites number 3 and 4 in the random sampling scheme were of greatest importance, trapping 31.4 percent and 29.4 percent, respectively, of the random catch (Table 3). Sites 2 and 5 also trapped good numbers of smolts throughout the season.

It is probable that the extremely large 1963 outmigration resulted in an atypical lateral distribution of smolts across the stream. The 1963 smolts, because of their large numbers, may have been forced to migrate in channels or paths not normally occupied in other years. The abnormal migration might be expected to have a marked effect on catches made in the five random sampling nets.

Age Composition

Lengths, weights, and scales were collected periodically throughout the season. Table 4 gives the index smolt catch, percentage of the season's catch, number of smolts measured and numbers of scales read.

Table 1. Ugashik River red salmon smolt catch in index net by hour and day, 1963.

Date	Index hours and catch						Total Catch	
	2000-2100	2100-2200	2200-2300	2300-2400	2400-0100	0100-0200	Daily	Cumulative
May 5	0	0	0	1	0	0	1	1
6	0	0	0	1	0	1	2	3
7	0	0	0	2	1	8	11	14
8	14	1	5	3	0	3	26	40
9	41	290	52	71	284	289	1,027	1,067
10	105	26	40	14	12	19	216	1,283
11	0	6	33	137	45	59	280	1,563
12	2	284	456	338	198	81	1,359	2,922
13	0	1	28	7	11	4	51	2,973
14	0	163	650	734	830	1,794	4,171	7,144
15	0	75	2,886	5,406	3,424	303	12,094	19,238
16	0	20,430	53,366	23,936	15,868	29,293	142,893	162,131
17	394	2,859	2,052	707	386	357	6,755	168,886
18	3	147	775	422	341	221	1,909	170,795
19	0	1	1,015	1,336	756	304	3,412	174,207
20	0	32	455	1,060	488	638	2,673	176,880
21	111	1,216	2,232	1,353	1,664	1,873	8,449	185,329
22	30	18	45	5	10	3	111	185,440
23	0	11	1,154	1,032	77	30	2,304	187,744
24	2	26	5,444	45,439	21,495	11,931	84,337	272,081
25	0	69	1,365	3,782	556	555	6,337	278,418
26	0	0	1,022	8,264	1,344	234	10,864	289,282
27	216	6,046	17,387	60,467	34,865	38,694	157,675	446,957
28	0	65	12,325	44,353	12,978	1,345	71,066	518,023
29	0	0	2,549	13,995	12,561	1,080	30,185	548,208
30	2	4,628	10,395	37,128	9,165	11,794	73,112	621,320
31	218	3,876	23,511	15,838	6,174	3,196	52,813	674,133
June 1	827	10,526	19,638	31,390	11,002	8,914	82,297	756,430
2	0	485	13,693	1,149	696	462	16,485	772,915
3	0	0	0	0	2	7	9	772,924
4	0	0	0	2	6	18	26	772,950
5	12	9,043	2,333	6,548	8,119	12,249	38,304	811,254
6	4,217	5,121	10,427	7,737	16,217	20,935	64,654	875,908
7	1	275	7,523	21,699	15,432	2,691	47,621	923,529
8	23,492	31,443	6,446	6,758	25,456	11,587	105,182	1,028,711
9	928	4,608	34,959	19,249	4,014	4,982	68,740	1,097,451
10	3,290	2,860	29,742	33,499	14,032	3,483	86,906	1,184,357
11	0	5,052	4,989	3,878	3,317	4,498	21,734	1,206,091
12	0	30	322	173	121	90	736	1,206,827
13	38	874	1,190	1,882	2,409	2,581	8,974	1,215,801
14	1	605	2,494	3,106	3,531	1,556	11,293	1,227,094
15	11	1	480	718	835	256	2,301	1,229,395
16	0	0	27	696	570	276	1,569	1,230,964
17	0	910	2,851	2,452	2,475	4,354	13,042	1,244,006
18	83	0	553	926	488	483	2,533	1,246,539
19	0	405	96	241	56	7	805	1,247,344
20	13	0	19	51	19	41	143	1,247,487
21	0	3	5	37	57	4	106	1,247,593
22	5	0	28	93	90	17	233	1,247,826
23	0	0	0	3	2	0	5	1,247,831

-Continued-

Table 1. Ugashik River red salmon smolt catch in index net by hour and day, 1963
(continued).

Date	Index hours and catch						Total Catch	
	2200-2100	2100-2200	2200-2300	2300-2400	2400-0100	0100-0200	Daily	Cumulative
24	0	0	0	0	0	1	1	1,247,832
25	0	0	220	994	462	378	2,054	1,249,886
26	292	0	19	73	19	30	433	1,250,319
TOTAL	34,348	112,511	277,296	409,185	232,970	184,009	1,250,319	1,250,319
PERCENT	2.75	9.00	22.18	32.72	18.63	14.72	100.00	

Table 2. Ugashik River red salmon smolt catch in index net over 24-hour period, 1963.

Date	Catch by Time Periods						
	2000-0200	0200-0330	0330-0500	0500-0630	0630-0800	0800-0930	0930-1100
May 7	11	11	2	0	0	0	0
12	1,359	40	1	0	0	0	0
17	6,755	540	3	0	0	0	1
22	111	3	1	0	0	1	0
27	157,675	22,778	4	0	0	0	1
June 1	82,297	6,327	1,843	0	160	65	1
6	64,654	8,372	4	28	1	1	676
11	21,734	1,471	0	0	0	347	631
16	1,569	16	72	9	26	0	0
21	106	7	12	0	0	0	0
26	433	8	0	0	0	0	0
TOTAL	336,704	39,573	1,942	37	187	414	1,310

Date	Catch by Time Period						Total
	1100-1230	1230-1400	1400-1530	1530-1700	1700-1830	1830-2000	
May 7	0	0	0	0	0	0	24
12	0	0	0	0	0	0	1,400
17	1	1	0	0	0	1	7,302
22	0	0	0	0	1	0	117
27	0	0	0	0	0	8	180,466
June 1	1	88	2,935	0	0	203	93,920
6	1,209	550	2	0	787	986	77,270
11	794	29	0	0	21	0	25,027
16	0	0	791	5	0	0	2,488
21	0	0	4	1	0	302	432
26	0	0	0	2	1	0	444
TOTAL	2,005	668	3,732	8	810	1,500	388,890

Table 3. Ugashik River red salmon smolt catches in the random sampling scheme, 1963.

Date		Random Sampling Sites					Total Catch
		1	2	3	4	5	
May	5	0	2	3	0	2	7
	6	25	1	4	0	0	30
	8	3	0	6	1	1	11
	9	10	45	10	289	140	494
	10	18	24	38	14	17	111
	11	21	21	148	59	4	253
	13	62	461	23	28	6	580
	14	81	369	1,764	163	486	2,863
	15	54	758	3,020	5,406	61	9,299
	16	30,563	12,121	36,084	16,709	78,830	174,307
	18	48	58	4	775	243	1,128
	19	71	218	1,632	756	688	3,365
	20	6	5	113	1,060	560	1,744
	21	814	300	12,641	1,216	995	15,966
	23	48	113	1,293	30	0	1,484
	24	34	1,062	1,939	45,439	14	48,488
	25	5	244	118	555	2,529	3,451
	26	1,333	207	1,150	252	180	3,122
	28	30	2,195	1,197	12,325	2,269	18,016
	29	635	156	10,827	0	186	11,804
	30	696	7,643	39,168	4,628	1,284	53,419
	31	87	2,706	15,786	19,798	26	38,403
June	2	46	2	7,264	462	165	7,939
	3	320	1,679	10	2	5	2,016
	4	1	64	0	0	4	69
	5	565	10,094	58,584	8,119	162	77,524
	7	4,749	15,549	1,016	21,699	37,294	80,307
	8	15	672	47	11,587	3,377	15,698
	9	264	184	1,907	4,608	5,670	12,633
	10	3,653	290	4,779	31,854	224	40,800
	12	32	2,340	341	322	32	3,067
	13	774	2,084	1,215	874	385	5,332
	14	744	2,387	353	1,556	2,067	7,107
	15	2,149	383	1,450	718	79	4,779
	17	295	331	1,784	2,475	293	5,178
	18	158	3,489	649	488	43	4,827
	19	1,353	859	167	241	1	2,621
	20	19	546	17	41	12	635
	22	428	284	930	0	14	1,656
	23	33	201	4	0	0	238
	24	15	8	9	0	0	32
	25	139	364	614	378	0	1,495
TOTAL		50,396	70,519	208,108	194,927	138,348	662,298
PERCENT		7.61	10.65	31.42	29.43	20.89	100.00

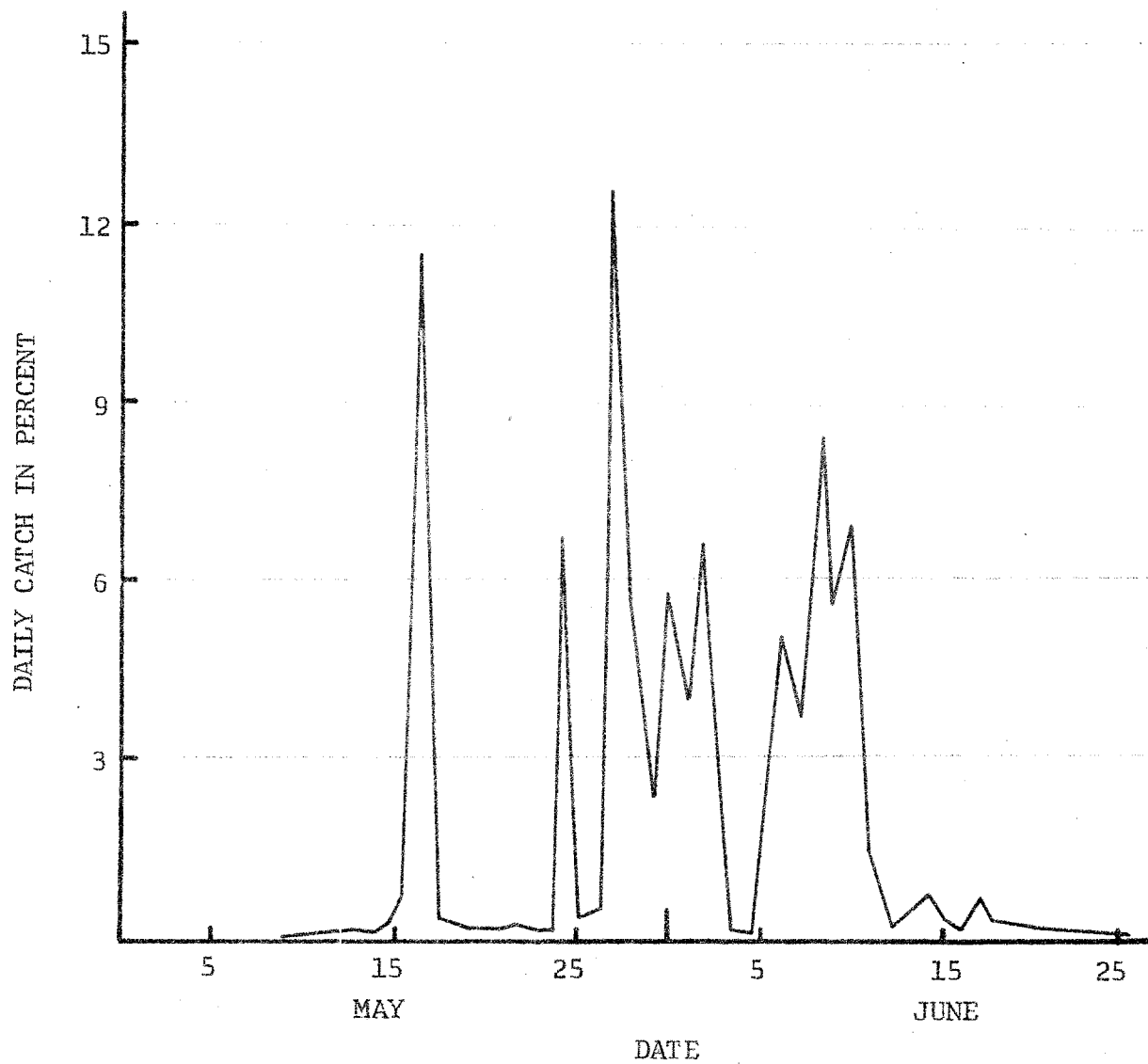


Figure 4. Daily index catches of red salmon smolt in percent of total index catch, Ugashik River system, 1963.

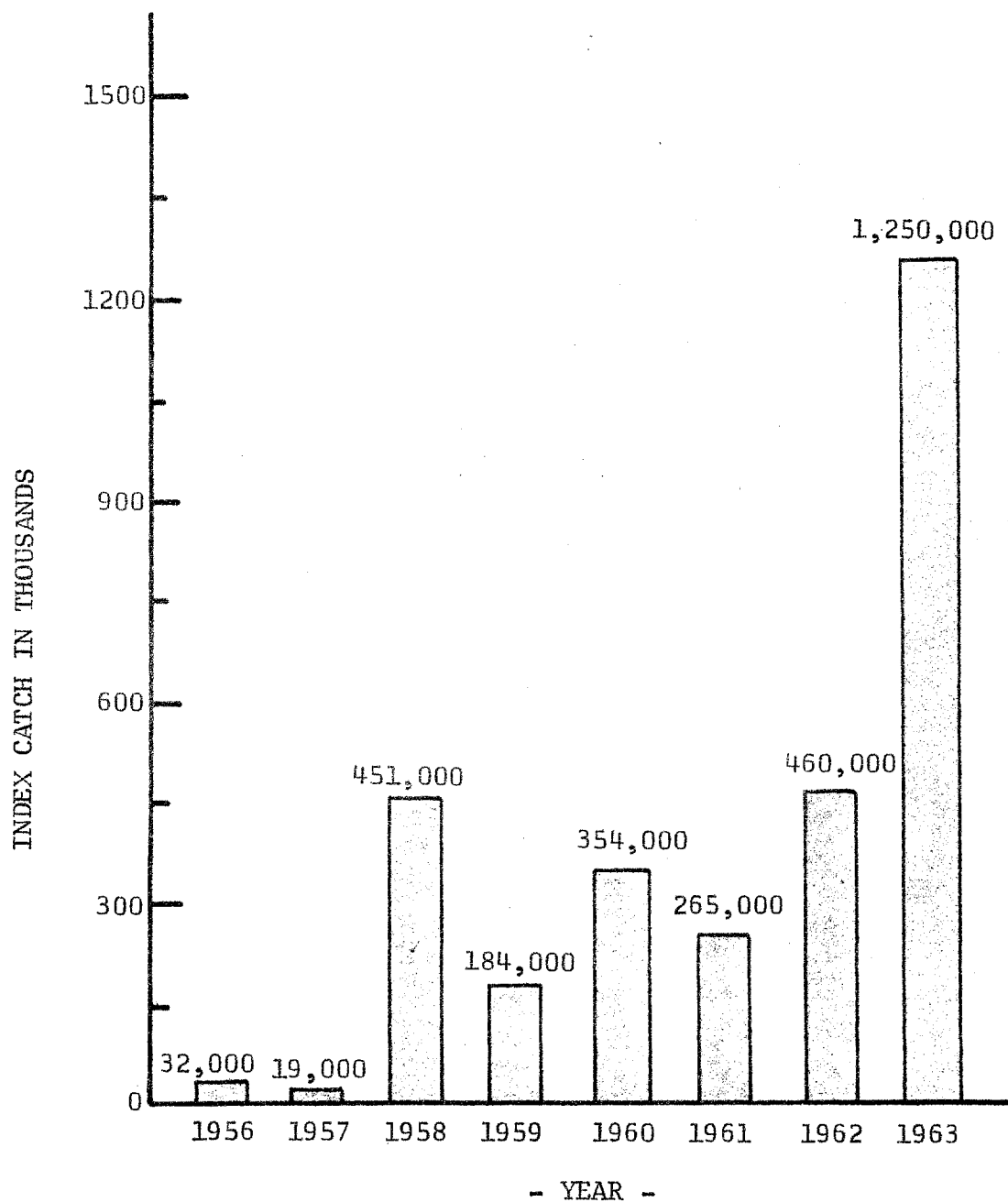


Figure 5. Relative magnitude of red salmon smolt catch in the index net, Ugashik River system, 1956-1963.

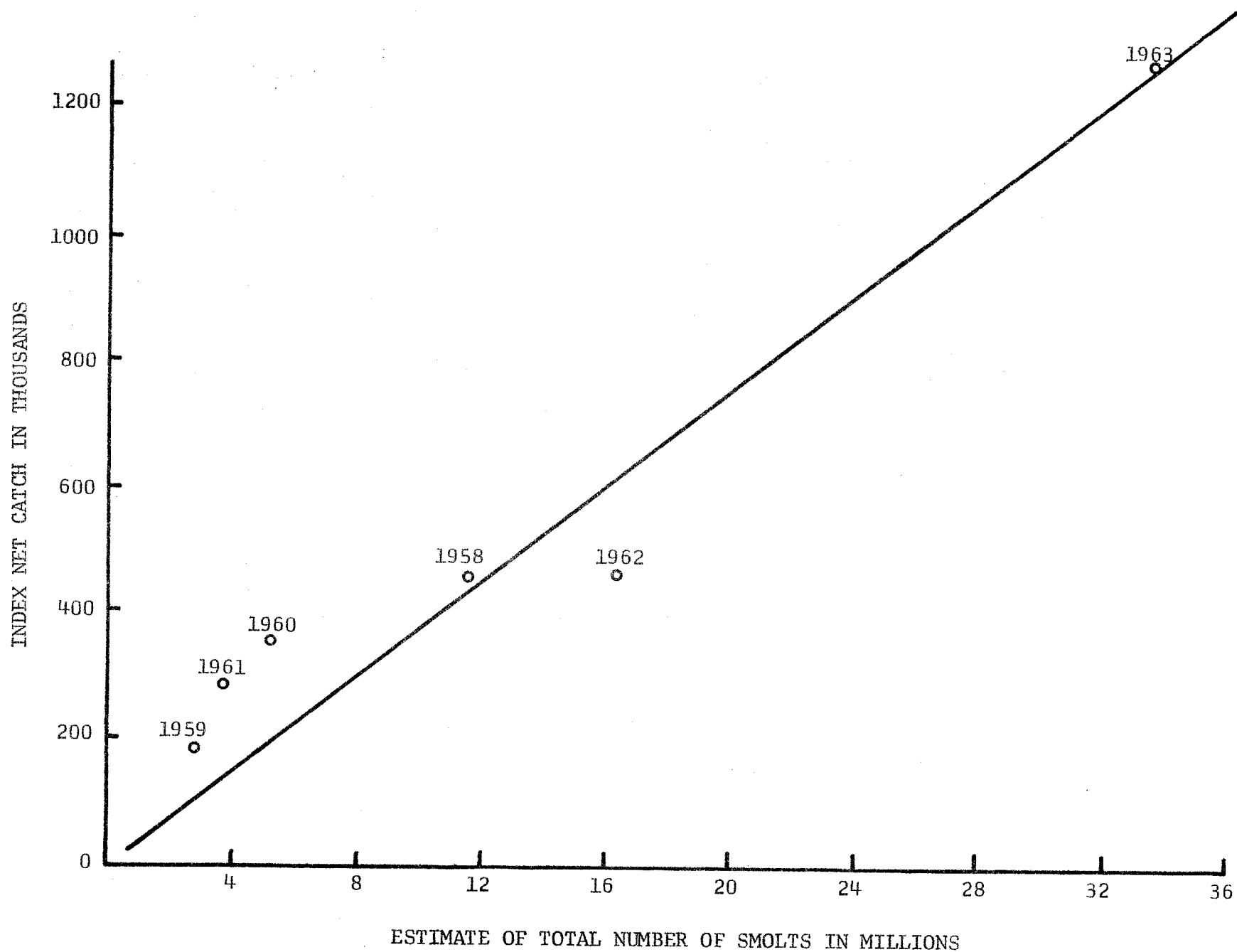


Figure 6. Annual indices and estimates of smolt outmigrations, Ugashik River, 1958-1963.

Table 4. Ugashik River red salmon smolt sampling data, 1963¹.

Period No.	Date	Index Smolt	Pct. of Seasons	No. of 1 lb. Samples	No. of Fish	No. of Scales
		Catch	Total	Measured	Measured	Read
1	May 5-14	7,144	.57	6	414	20
2	May 15-19	167,063	13.36	13	910	70
3	May 20-24	97,874	7.83	8	542	79
4	May 25-29	276,127	22.09	11	651	108
5	May 30-June 3	224,716	17.97	12	699	120
6	June 4-8	255,787	20.46	11	611	140
7	June 9-13	187,090	14.96	14	956	160
8	June 14-18	30,738	2.46	12	832	169
9	June 19-26	3,780	.30	5	314	55
TOTAL		1,250,319	100.00	92	5,929	921

¹ Data is consolidated into periods for ease of interpreting.

Age composition was based on readings of 921 scales contained in 26 1-pound scale samples. Size composition was determined from live length measurements of 5,929 smolts contained in 92 1-pound samples.

The age composition of the 1963 smolt outmigration for each sampling night is presented in Table 5. Age I smolts (fish in their second year of life) comprised 46.3 percent of the outmigration while Age II smolts (fish in their third year of life) comprised 53.7 percent of the outmigration.

In the past, most of the Age II fish have left Lower Ugashik Lake before the Age I fish appear in significant numbers. In 1963 there was a very significant number of Age I fish that left the lake before the older age group.

The average fork length of Age I smolts was 90 mm, while Age II smolts averaged 104 mm in length. Comparable fork lengths for the years 1958 through 1963 are given in Table 6.

The average weight of Age I smolts was 6.1 grams, while Age II smolts average 9.6 grams. The 1963 fish were generally shorter and weighed less than the 1958 to 1962 fish (Table 6). The decrease in growth can probably be attributed to the larger populations of smolt within the Ugashik Lakes.

Table 7 summarizes the comparative age, length, index catches, and outmigration estimates for the years 1956 through 1963.

Smolt Production vs Escapement Levels

The 1963 smolt outmigration originated from the adult escapements of 2,304,200 in 1960 and 348,639 in 1961. The number of smolts arising from specific brood years has varied from 4.0 million smolts from a parent 1959 escapement of 219,228 to 31.6 million smolts from a parent 1960 escapement of 2,304,200 (Table 8).

The relationship between escapement levels and resultant smolt production indicates that an increase in smolt production results with increased escapement. The smolts that resulted from the 1960 escapement supports this contention strongly.

The 1961 brood year escapement of 348,639 has so far produced 15.6 million Age I smolts (Table 8). The large seasonal migration in 1963 of Age I smolts indicates that the freshwater survival of the 1961 progeny has been very good. The Age III smolts from the 1961 escapement will not leave freshwater until the spring of 1964. After the 1964 season it will be possible to construct total smolt production figures for the 1961 brood year.

Table 5. Age, length, and weight of red salmon smolts in the Ugashik River system, 1963¹.

Date	No. smolts in sample	Mean Length of Age Group		Percentage of Age Group ²		Mean Weight of Age Group	
		I	II	I	II	I	II
May 12	20	85	101	45.0	55.0	5.4	8.3
16	40	88	99	42.5	57.5	5.3	7.6
17	30	--	--	63.3	36.7	--	--
23	40	90	104	65.0	35.0	6.0	8.8
24	39	89	102	30.8	69.2	5.6	8.4
27	40	87	102	32.5	67.5	6.4	9.5
28	38	90	103	47.4	52.6	5.6	9.0
29	30	89	109	23.3	76.7	6.2	11.2
30	40	88	103	40.0	60.0	5.7	9.0
31	40	89	113	47.5	52.5	6.0	12.1
June 1	40	92	100	52.5	47.5	6.1	8.1
5	40	91	110	27.5	72.5	6.3	10.6
6	40	92	106	37.5	62.5	6.9	10.1
7	30	90	107	70.0	30.0	6.3	10.1
8	30	92	106	50.0	50.0	6.9	10.9
9	40	90	110	32.5	67.5	6.0	11.3
10	40	90	107	77.5	22.5	5.8	10.0
11	40	90	103	82.5	17.5	6.0	8.4
13	40	91	116	77.5	22.5	6.0	12.8
14	40	89	109	92.5	7.5	5.9	10.8
15	30	92	108	76.7	23.3	6.5	10.4
16	30	93	119	53.4	43.3	6.9	11.9
17	40	92	103	87.5	12.5	6.2	9.0
18	29	90	110	89.7	10.3	6.1	11.1
19	25	94	117	68.0	32.0	7.0	13.2
25	30	89	101	86.7	10.0	5.9	7.3
WEIGHTED							
AVERAGE	921	90	104	46.33	53.66	6.1	9.6

¹ Weighted by index catch.

² Age III smolt make up 0.01 percent of the run.

Table 6. Average length and weight of Ugashik River red salmon smolts, 1968-63¹.

Year of Seaward Migration	Age I		Age II	
	Length	Weight	Length	Weight
1958	93	6.4	112	11.7
1959	90	6.1	120	13.5
1960	90	6.6	108	11.0
1961	90	6.7	112	12.2
1962	88	6.1	112	12.3
1963	90	6.1	104	9.6
AVERAGE	90	6.3	111	11.7

¹ Weighted by index catch.

Table 7. Comparative age, length, index catches, and outmigration estimates of red salmon smolts from the Ugashik Lakes system, 1956-63¹.

Year of Seaward Migration	Age I		Age II		Index Catch	Outmigration Estimate
	Percent	Mean Length	Percent	Mean Length		
1956	11.0	-	89.0	-	32,000	-
1957	4.0	-	96.0	-	19,000	-
1958	98.1	93	1.9	112	451,352	11,659,905
1959	87.3	90	12.7	120	183,763	2,887,002
1960	59.7	90	39.3 ²	108	354,173	5,503,646
1961	20.4	90	79.6	112	264,696	3,802,079
1962	80.7	88	19.3	112	460,103	16,692,089
1963	46.3	90	53.7 ³	104	1,250,319	33,750,496
Average	50.9	90	48.9	111	376,926	12,382,536

¹ Weighted by index catch.

² 1.0 percent Age III smolts.

³ 0.1 percent Age III smolts.

Table 8. Ugashik River red salmon escapements and smolts produced, 1956-61.

Brood Year	Escapement	Millions of Smolts Produced			Total
		Age I	Age II	Age III	
1956	425,295	11.4	0.4	0.1	11.9
1957	214,802	2.5	2.2	-	4.7
1958	279,546	3.3	3.0	-	6.3
1959	219,228	0.8	3.2	-	4.0
1960	2,304,200	13.5	18.1	-	31.6
1961	348,639	15.6	<u>1</u> /	-	-

¹ The Age II smolts from the 1961 escapement will not leave freshwater until 1964.

SUMMARY

1. In 1963 the Alaska Department of Fish and Game continued smolt enumeration and sampling at the outlet of Lower Ugashik Lake. The program was formerly conducted by the Fisheries Research Institute in 1956 and 1957 and by the U.S. Bureau of Commercial Fisheries from 1958 through 1962. This was the Department's first year of conducting the smolt program.
2. The index of smolt abundance was obtained by the use of the standard fyke net and similar sampling methods comparable with previous years.
3. Two sampling schemes were employed to obtain two estimates of abundance. The index system used since 1956 gives an estimate of the relative smolt abundance from year to year. The random sampling scheme used since 1958 gives an estimate of the total smolt outmigration.
4. The 1963 trapping program commenced on May 5. Heavy seaward migration was delayed until the water temperature at the lake outlet reached 37° - 39° F. Trapping was discontinued on June 26.
5. The largest catches were made during the darkest hours of the night, as over 73 percent of the catch in the index net occurred between the hours of 10:00 p.m. and 1:00 a.m. The largest index catch was made on May 27.
6. The 1963 Ugashik River smolt index catch and total outmigration estimates were the highest on record. A total of 1,250,319 smolts were caught in the index net and the total smolt outmigration estimate was 33,750,496.
7. Fyke net sites number 3 and 4 continued to intercept the major portion of the seaward migration, with over 60 percent of the random net catches being recorded in these two sites.
8. Age I smolts comprised 46.3 percent of the total outmigration and averaged 90 mm in length and 6.1 grams in weight. Age II smolts comprised 53.7 percent of the outmigration and average 104 mm in length and 9.6 grams in weight.
9. The 1963 smolt run originated from the adult escapements of 2,304,200 in 1960 and 348,639 in 1961.
10. The total smolt return of 31.6 million from the 1960 brood year indicates that a marked increase in smolt production results from increased escapement.

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